H. E. McCoy

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D MA 1400.021 (Project)	DATE DEC 16 1965

APOLLO PROGRAM DIRECTIVE NO. 13

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FROM:

DIRECTOR, APOLLO PROGRAM

SUBJECT: Apollo Program Flight Mission Directive for Apollo-Saturn 203 Mission

REFERENCES: (a) Apollo Flight Mission Assignments, SE010-000-1
(b) Apollo Program Development Plan, MA001.000-1
(c) Mission Operations Directive No. 3, dated 11/5/65, MO 2200.017
(d) MSFC Flight Mission Directive, Apollo-Saturn 203 Mission, dated September 1, 1965

1.0 MISSION PURPOSE

1.1 Purpose: The purpose of the Apollo-Saturn 203 Mission is to (a) verify the Saturn V/S-IVB systems operation by simulating the Saturn V Lunar Mission operation of the S-IVB stage in earth orbit, (b) provide technological data pertinent to the behavior and management of liquid hydrogen in earth orbit, and (c) continue development of the Saturn IB for manned flights.

1.2 Primary Objectives: Primary objectives of the Apollo-Saturn 203 Mission are tabulated below. The primary objectives of the mission shall be those identified in reference (a). When appearing in the Center mission directive, they may be amplified, but not modified, as required by the Centers. The primary objectives are those which are mandatory. Malfunctions of launch vehicle systems, ground equipment, or instrumentation which would result in failure to achieve these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Evaluate the S-IVB LH_2 continuous venting system.

b. Evaluate the S-IVB engine chilldown and recirculation system.

c. Determine S-IVB tank fluid dynamics.

d. Determine heat transfer into liquid H_2 through tank wall, and obtain data required for propellant thermodynamic model.

e. Evaluate S-IVB and IU checkout in orbit.

f. Demonstrate orbital operation of the launch vehicle S-IVB attitude control and thermal control systems.

g. Demonstrate the ability of the launch vehicle guidance to insert a payload into orbit.

h. Demonstrate operational structure of the launch vehicle.

i. Demonstrate the mission support facilities and operations required for launch and mission conduct.

2.0 GENERAL FLIGHT PLAN

The Apollo-Saturn 203 Mission will be an earth orbital, unmanned flight. Recovery is not planned for this mission.

The following summarizes the general flight plan requirements for this mission:

2.1 Launch Vehicle Powered Flight: AS-203 will be launched from Launch Complex 37B at Cape Kennedy on a 90° E of N launch azimuth and rolled to a 72° initial flight azimuth. The S-IB boost phase will utilize a pre-set time-tilt program to produce the required gravity turn trajectory. Following S-IB staging and S-IVB ignition, active adaptive guidance will be used to insert the S-IVB with approximately 19,000 lbs. of LH_2 into a 100-nautical mile circular orbit.

2.2 Orbital Flight: The flight will be planned for at least three orbits during which time major events such as continuous venting, restart simulations, free liquid phenomena and resettling will be performed to satisfy the primary objectives of the flight.

2.3 Tracking and Data Acquisition: The operations support requirements covering tracking and telemetry will be those specified in the Program Support Requirements Document revisions for this mission which will be distributed by January 1, 1966.

In general, tracking support is required from lift-off throughout flight duration until reentry into the atmosphere. Continuous telemetry coverage is required throughout the launch phase and intermittent coverage during the active orbital life of the vehicle to insure data acquisition coverage of the major flight events.

2.4 Recovery: Recovery of the payload is not planned for this mission. Camera capsules ejected from the launch vehicle will be recovered in accordance with requirements stated in the Program Support Requirements Document (AS-203 Revision).

2.5 Payload Requirements: The orbital payload for this flight will be S-IVB stage with approximately 19,000 lbs. of LH_2, the Instrument Unit for guidance and control and a double angle universal nose cone.

3.0 CONFIGURATION

3.1 S-IB Stage: This stage will be flight weight structure of the standard operational Saturn IB.

3.2 S-IVB Stage: For the AS-203 Mission the S-IVB will be modified as required to simulate a Saturn V S-IVB configuration and to obtain data on LH_2 phenomena. Major modifications and additions will include:

a. Forward skirt structural modifications

b. LOX Tank Baffle installation

c. LH_2 Tank Baffle installation

d. LH_2 Vent System modification to simulate Saturn V configuration

e. LOX Tank Vent System to simulate Saturn V APS ullage engine

f. Special manhole covers for TV viewing

g. LH_2 experiment instrumentation

3.3 Nose Cone: A semimonocoque double angle nose cone of proven design will be used. It will remain attached to the S-IVB and IU in orbit.

3.4 In-Flight Experiments: A liquid nitrogen storage sphere, bracketry and instrumentation will be mounted in the Nose Cone for the MSC-13 Subcritical Cryogenic Storage experiment. This experiment shall be included on a non-interference basis and its purpose is considered a secondary objective. The experiment will examine the stratification of the liquid phase, quantity measurement of the two phase fluid, and uniformity of gas flow in the space environment.

4.0 SUPPORTING TEST CONSTRAINTS

4.1 Qualification: Major components of the AS-203 space vehicle critical to the accomplishment of the Apollo-Saturn 203 Mission Objectives will be ground qualified and acceptance tested prior to launch. Because of the instrumentation relation to the success of the mission, qualified instrument systems and TV systems are required.

4.2 Ground Test: The following major stage and vehicle ground tests will be performed to the extent required to support the Apollo-Saturn 203 Mission:

a. S-IB stage structural test of tail section and propellant tanks.

b. Successful completion of AS-203 stage manufacturing checkout, static firing, post static firing and pre-launch checkout tests.

c. Successful completion of S-IU-203 manufacturing and pre-launch checkout tests.

d. Laboratory vibration test of nose cone with simulated MSC cryogenic experiment hardware.

e. Saturn IB Dynamic Test of complete 203 vehicle configuration and 203 upper stage configuration simulated by LEM adapter cone.

f. Facility checkout of Launch Complex 37B.

g. GSE Systems verification of Launch Complex 37B.

4.3 Flight Tests: Successful completion of AS-201 and 202 flight test objectives are not a constraint on AS-203.

4.4 Certification: A Certificate of Flight Worthiness (COFW as outlined in Apollo Test Requirements, NPC 500-10) for each stage, IU, and module is required prior to shipment from the manufacturing site. MSFC Program Directive Number T-1-1, dated June 30, 1965, outlines procedures which are acceptable to fulfill this requirement pending final issue of MSFC COFW Procedure currently being coordinated.

5.0 RESPONSIBILITIES

5.1 MSF:

a. The Apollo Program Director is responsible for overall management of the space vehicle development including definition of mission objectives, the flight hardware configuration, and supporting ground test constraints as well as the integration and checkout of the space vehicle prior to launch.

b. The Mission Operations Director is responsible for coordination of all mission operations planning activity and for insuring that all requirements, plans, schedules, procedures and directives required to conduct the mission are generated. Overall organizational responsibilities and relations are given in the Program Development Plan (reference b) and in the AS-203 Mission Operations Plan (reference c).

c. During the mission period, the Mission Director is responsible for the overall direction of each Apollo-Saturn mission.

5.2 MSFC:

a. MSFC is responsible for the development of the AS-203 launch vehicle and engines, and for the associated ground support equipment.

b. MSFC is responsible for the stages and stage associated GSE checkout and acceptance, and delivery of these stages and GSE to KSC.

c. MSFC is to provide the technical support to KSC and MSC as required during the acceptance, pre-launch checkout and the launch and flight phases of the mission. MSFC representation at MSC specifically in support of the Liquid Hydrogen Experiment is described in reference (c).

5.3 MSC:

a. MSC is responsible for the Subcritical Cryogenic Storage Experiment No. 13. This experiment is to be performed on a non-interference basis and is listed as a secondary objective.

b. The data gathering responsibilities and the launch, flight and recovery responsibilities are delineated in the Program Support Requirements Document Revisions for AS-203 to be issued by January 1, 1966 and in the Mission Operations Plan, Apollo-Saturn 203 dated November 5, 1965.

5.4 KSC:

a. KSC is responsible for the development and activation of the launch and checkout facilities.

b. KSC is responsible for GSE preparation and pre-launch checkout of the launch vehicle as delegated by MSFC.

c. KSC is responsible for the task of physically integrating and checking out the total space vehicle with technical support from MSFC as required.

6.0 IMPLEMENTATION

The MSFC Mission Directive (reference d) which provides the specific detailed requirements necessary to carry out the mission is considered an integral part of this Mission Directive and is hereby approved.

Subsequent changes and future revisions to the Center Directive which conflict with the requirements stated herein will require review and approval of the Apollo Program Director. Other revisions to the Center Directive will be made as required and copies submitted to the Apollo Program Director for information.

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